

BOLIVIAN PHLEBOTOMINES. II. *PSYCHODOPYGUS YUCUMENSIS* N.SP.,  
A NEW MAN-BITING PHLEBOTOMINE SANDFLY FROM  
SUBANDEAN REGION (DIPTERA, PSYCHODIDAE)

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*Psychodopygus yucumensis n.sp.*, a new species of Phlebotomine sandfly belonging in genus *Psychodopygus* Mang., is described from specimens collected from human bait, in Beni dept., Bolivia. The male is characteristic of the series *panamensis*, but the female, closely related to *P. carrerai carrerai*, can be confused with this species ("cryptic species"). Isozyme characterization can determine any specimen of either species, while morphometric analysis shows statistical differences between the two species.

*P. yucumensis* is strongly anthropophilic. A *Leishmania braziliensis braziliensis* stock was isolated from this new species, indicating that it is one of the vectors of mucocutaneous Leishmaniasis in the lowland subandean area.

Key-words: *Psychodopygus carrerai* – cryptic species – morphological description – leishmaniasis

Members of the genus *Psychodopygus* Mangabeira 1941 constitute the dominant group of anthropophilic Phlebotomine sandflies in primary forest of the lowland subandean region of Bolivia (elevation 200-1000m) (Le Pont, unpublished data). This group has a well-known distinctive epidemiological significance (Ready et al., 1980); indeed several species have been considered as vectors or probable vectors of mucocutaneous Leishmaniasis caused by *Leishmania braziliensis* s.l. (Lainson et al., 1973). Between some related taxa of *Psychodopygus* the females are sometimes indistinguishable by means of classical morphological characters ("cryptic species") (Ready et al., 1982; WHO report, 1984) and it is therefore necessary to look for minor morphological or colorimetric differences in order to distinguish them accurately. A powerful tool for this diagnostic of cryptic species (if they live in sympatric conditions) is provided by isozyme analysis. Captures on human bait in the Alto Beni region allowed the capture in sympatric conditions of two sets of specimens seeming to belong to the taxon *P. carrerai carrerai*: some specimens exhibited typical features of this species while others showed a light brown mesonotum.

Electrophoretic analysis of these two sets of specimens showed that they are genetically isolated (Le Pont et al., 1985) and hence that they are distinct species, one being the formerly described *P.c. carrerai*, the other being a new species.

We present here a morphological description of this new species as well as a morphometrical comparison between the two cryptic species.

All measurements in the text are in millimeters; all specimens are mounted on microslides in Euparal medium.

*Psychodopygus yucumensis* Le Pont, Caillard, Tibayrenc & Desjeux n.sp.

**Holotype** ♂: a small pale sandfly approximately 2.40 long from tip of labrum to end of coxite with only mesonotum light brown; posterior part aspect of parapsidal sutures without pigmentation; coxae and pleura white, abdomen pale yellow (Figs. 1-5).

**Head:** 0.328 long, including clypeus, by 0.356 wide (max.); *interocular distance* = to about 3 facets; *labrum* 0.163 long, from tip of clypeus; *flagellomere I* (A 3) 0.218 long, combined length of II + III (A4 + A5) 0.195; *ascoïds* simple as figured; *palps* 0.294 long; length of palpal

This study was carried out with support from the French Technical Cooperation Program and from the Ministère de l'Industrie et de la Recherche; extension of grant number PVD/81/L-1423.

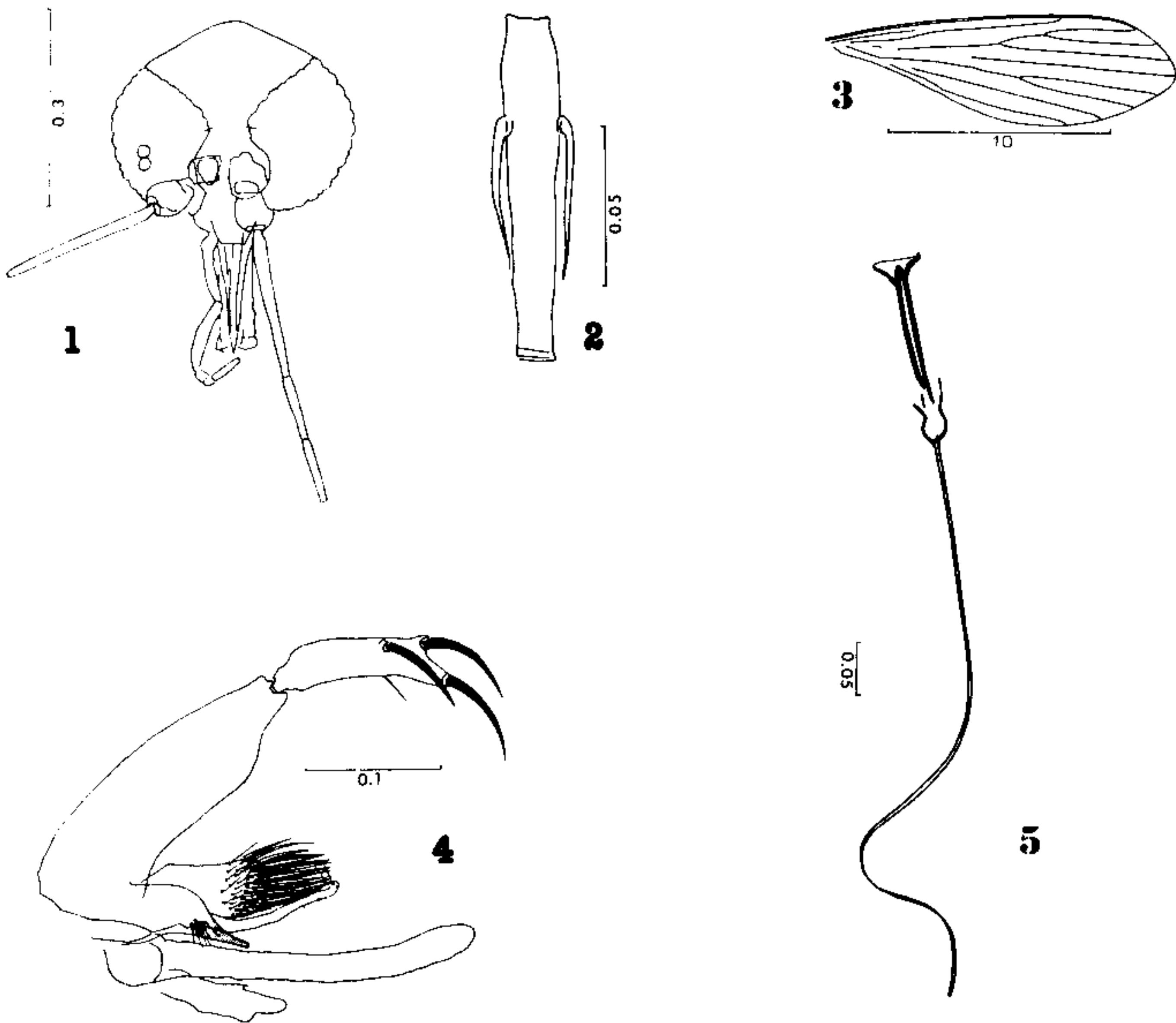
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Received for publication July 5th and accepted September 10th, 1985.



*Psychodopygus yucumensis* n.sp. male. Fig. 1: head. Fig. 2: flagellomere II (A4). Fig. 3: wing. Fig. 4: genitalia. Fig. 5: genital filaments and pump.

segments: 1-0.025; 2-0.071; 3-0.120; 4-0.029; 5-0.049; *palpal formula*: 1-4-5-2-3; *cibarium* with about 15-20 scattered dotlike vertical teeth; *chitinous arch* visible only at sides; no *pigment patch*; *pharynx* 0.17 long, unarmed.

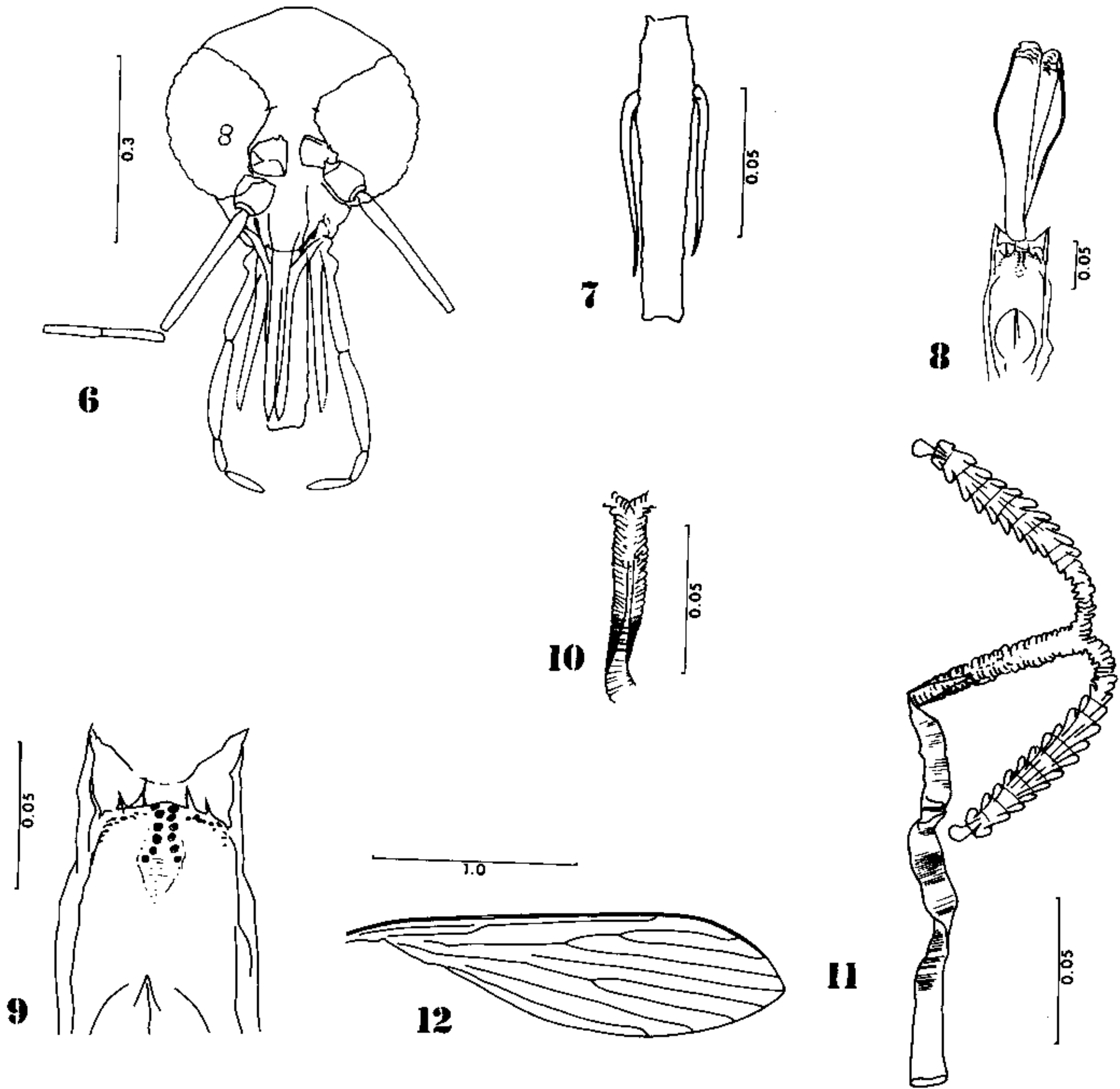
*Thorax*: 0.490 long with mesonotum infuscated but not as much as the female; *mesane-pisternum* with 18 upper and 9 lower setae; *wings* 1.65 long by 0.51 wide (max.); length of *wing vein sections*: alpha 0.43, beta 0.23, gamma 0.14, delta 0.08; length of *femorae, tibiae* and *basitarsi*: foreleg 0.72, 1.05, 0.7; midleg 0.68, 1.14, 0.76; hindleg 0.74, 1.32, 0.76.

*Abdomen*: 1.38 long including coxite. *Coxite* 0.217 long by 0.071 wide (max.) without nondeciduous setae; length inferior to the one of *lateral lobe* (= 0.267 long); *style* 0.227 long by 0.031 wide (max.) with three spines and a small bristle inserted at the same level as the lowest spine; *paramere* with apical tuft of 25-30 long, strong, curved, blade-like setae not surpassing the ventral digitate process as shown; *aedeagus* broad, infuscated at distal end; *genital filaments* 0.588 long or approximately 5x length of *pump* 0.119.

**Allotype** ♀: also pale coloured except for mesonotum with a light-brown pigmentation; length 2.94 (Figs. 6-12).

*Head*: 0.39 long, including clypeus, by 0.40 wide (max.); *interocular distance* (narrowest) 0.70 = to about 5 facets; *labrum* 0.28 long, from tip of clypeus; *flagellomere I* (A3) 0.226 long, combined length of II + III (A4 + A5) 0.19; *ascoïds* simple as in ♂, a little more developed; *palps* 0.447 long with individual segments of length: 1-0.035, 2-0.129, 3-0.161, 4-0.050, 5-0.072; *palpal formula*: 1-4-5-2-3; *cibarium* with four horizontal subequal sharpened teeth, the median ones being separated by a larger distance than the distance between median and lateral ones; two

median longitudinal irregular rows of 4-7 large erected teeth in each row, diverging anteriorly and a file of dense small vertical pointed teeth restricted to the anterior side of the bar from which horizontal teeth arise; *pigmented area* little perceptible except for wrinkles; high *chitinous arch*, barely visible; *pharynx* (0.19 long) unarmed.



*Psychodopygus yucumensis* n.sp. female. Fig. 6: head. Fig. 7: flagellomere II (A4). Fig. 8: cibarium and pharynx. Fig. 9: cibarium. Fig. 10: rugose section of the common spermathecal duct of *P.c. carrerai* (Bolivia). Fig. 11: spermathecae of *P. yucumensis*. Fig. 12: wing.

*Thorax*: 0.64 long, with most part of the mesonotum light-brown, contrasting with the pale colour of the rest of the insect body, scutellum included; *mesanepisternum* with 14 upper and 10 lower setae; *wings* 2.220 long by 0.640 wide (max.); length of *wing vein sections*: alpha 0.58, beta 0.26, gamma 0.17, delta 0.17, alpha/beta is 2.23; *legs* normal; length of *femur*, *tibia* and *basitarsus* of hindleg: 0.83, 1.58, 0.92 respectively.

*Abdomen*: 1.63 long. Spermathecae imbricated as shown in Fig. 11; body of the *spermatheca* 0.068 long with annulations varying from 9 to 12; terminal segment symmetrical and "terminal knob" little pendulous; short *individual ducts* 0.015 long; *common sperm duct* 0.192 long with base of the rugose section "V" shaped and proximal 2/3 as a simple walled tube.

**Type locality**: Km 4 road Yucumo-Rurrénabaque, side of the Serrania del Pilon, department of Beni, Bolivia.

**Types**: Holotype male (slide no. 13.11), 8 paratypes males (slides no. 13.12-13.19), allotype female (slide no. 10.11), 8 paratypes females (slides no. 10.12-10.19) taken from human bait in primary forest behind dwellings of Km 4, road Yucumo-Rurrénabaque (July 1984).

Holotype, allotype, 2 paratypes males and 2 paratypes females to be deposited at S.S.C., O.R.S.T.O.M., Entomologie Médicale, Service de Faunistique, 70-74 route d'Aulnay, 93140 Bondy-France; the other paratypes deposited as follows: 2 males and 2 females at Instituto Evandro Chagas, Belém, Pará state, Brazil; 2 males and 2 females at Faculdade de Saúde Pública da Universidade de São Paulo, and 2 males and 2 females at Florida State Collection of Arthropods, Gainesville, Florida, U.S.A.

## DISCUSSION

Tables I, II and III.

*P. yucumensis* belongs in genus *Psychodopygus* Mangabeira 1941, series *panamensis* as defined by Theodor (1965), which includes the following species: *P. carrerai* (Barretto), *P. hirsuta* (Mangabeira), *P. panamensis* (Shannon), *P. paraensis* (Costa Lima), *P. ayrozai* (Barretto & Coutinho), *P. recurva* (Young), *P. nocticola* (Young), *P. amazonensis* (Root), *P. clautrei* (Abonnenc, Leger & Fauran), *P. davisii* (Root), and the 2 species of uncertain status *P. pessoana* (Barretto) and *P. fairchildi* (Barretto).

TABLE I

Comparison of some features of *P. yucumensis*\* n.sp. and *P. c. carrerai*\* based on males flies collected in the focus of Yucumo, Bolivia and published data of earlier authors about related species

	Labrum length	A 3 length	Wing length	Genital filaments length	Genital pump length
<i>P. carrerai</i> Type (Colombia) (Barretto 1946)	0.167	0.243	1.6	0.297	0.086
<i>P. c. carrerai</i> (Bolivia)	0.158-0.185 (0.167)	0.203-0.239 (0.227)	1.58-1.79 (1.68)	0.550-0.650 (0.589)	0.112-0.140 (0.124)
<i>P. yucumensis</i> (Bolivia)	0.158-0.188 (0.169)	0.200-0.240 (0.218)	1.65-1.87 (1.76)	0.549-0.625 (0.585)	0.109-0.131 (0.118)
<i>P. pessoana</i> Type (South Brazil) (Barretto 1955)	0.179	0.250	1.190**	0.555	0.162
<i>P. fairchildi</i> Type (South Brazil) (Barretto 1966)	0.253	0.281	1.9	0.620	0.153

\*The means and ranges in size of the body parts of sandflies from Yucumo are based on 18 specimens of *P. yucumensis* n.sp. and 13 specimens of *P. c. carrerai*.

\*\*Probably an error.

The *P. yucumensis* female closely resembles the *P.c. carrerai* one (Young 1979) for the cibarium, the type of spermatheca and the general pigmentation. Nevertheless two minor but consistent characters may be used to distinguish them from one another: 1) the "V" shaped base of the rugose section of the common duct in *P. yucumensis* is very easy to see while the "V" shaped base observed in Bolivian specimens of *P.c. carrerai* extends always a little towards the apex of the common duct and it seems to be more "Y" shaped than "V" shaped; 2) the most striking difference is the light-brown mesonotum of *P. yucumensis* contrasting with the completely pale one of *P.c. carrerai*.

The *P. yucumensis* male was referred to the female on the basis of collecting data and identity of the pigmentation. Moreover some specimens were caught "in copula". The male resembles males of *P. ayrozai*, *P. paraensis*, *P.c. carrerai*, *P. nocticola*, *P. pessoana* and *P. fairchildi*. The morphology and the setation of the *P. yucumensis* paramere is quite characteristic, the curved blade-like setae of the tuft converging posteriorly like a brush. In *P. ayrozai* the setation is less numerous and the lateral arm is shorter. *P. paraensis* and *P.c. carrerai* both have a fan-like distribution of setae, while the narrow paramere with a reduced setation of *P. nocticola* remains without equivalent. It is difficult to consider *P. pessoana* and *P. fairchildi* as valid species as there have been

TABLE II

A comparison of some features of *P. yucumensis*\* n.sp. and *P. c. carrerai*\* based on females flies collected in the focus of Yucumo, Bolivia

	<i>P. c. carrerai</i>		<i>P. yucumensis</i> n. sp.	
Body length (Thorax + Abdomen)	1,91 -2,32	(2,12)	2,14 -2,32	(2,24)
Head length (includ. clypeus)	0,381-0,43	(0,411)	0,39 -0,425	(0,411)
Head width	0,389-0,440	(0,413)	0,34 -0,450	(0,415)
Labrum length	**0,241-0,278	(0,257)	0,252-0,29	(0,271)
A 3 length	0,202-0,250	(0,227)	0,216-0,25	(0,232)
A 4 + A 5 length	0,195-0,233	(0,211)	0,190-0,220	(0,204)
Palpal seg. 1, length	0,027-0,041	(0,035)	0,030-0,041	(0,034)
2	0,103-0,122	(0,110)	0,103-0,129	(0,119)
3	0,129-0,158	(0,145)	0,143-0,162	(0,152)
4	0,037-0,055	(0,048)	0,041-0,057	(0,051)
5	0,061-0,079	(0,067)	0,062-0,080	(0,069)
Palpal length	0,371-0,442	(0,406)	0,408-0,459	(0,428)
Palpal formula	1 - 4 - 5 - 2 - 3		1 - 4 - 5 - 2 - 3	
Nº of upper mesepisternal setae	12		15	
Nº of lower mesepisternal setae	10		9	
Wing length	1,78 -2,27	(2,06)	2,07 -2,4	(2,20)
Wing width	0,54 -0,68	(0,62)	0,63 -0,71	(0,65)
Alpha	0,47 -0,64	(0,56)	0,58 -0,67	(0,61)
Beta	0,19 -0,28	(0,23)	0,22 -0,29	(0,26)
Gamma	0,14 -0,21	(0,18)	0,10 -0,19	(0,14)
Delta	0,12 -0,23	(0,17)	0,12 -0,2	(0,16)
Spermathecae annuli	10		10	
Spermatheca length	0,035-0,060	(0,051)	0,050-0,068	(0,055)
Individual duct length	0,025-0,033	(0,027)	0,015-0,037	(0,030)
Common duct length	0,178-0,27	(0,222)	0,153-0,225	(0,190)
Base of the rugose section of the common sperm duct	*** "Y" shaped		"V" shaped	

\* The means and ranges in size of the body parts of sandflies from Yucumo are based on 10 specimens of *P. yucumensis* n. sp. and 10 specimens of *P. c. carrerai*, except for labrum, antennal flagellomere I and wing length (20 specimens).

\*\* 0.24-0.27 (0.25) n = 20 for Colombian specimens of *P. c. carrerai* (Young 1979).

\*\*\* "V" shaped for Colombian specimens of *P. c. carrerai* (Young, 1979).

several mistaken identifications as non-dimensional species (Martins et al., 1973). Young (1979) considers *P. pessoana* as a junior synonym of *P. c. carrerai*, the status of *P. fairchildi* needs to be clarified.

We performed a statistical comparison of some morphometric data between *P. c. carrerai* and *P. yucumensis* by means of Student's t test. It showed statistically significant differences for the following characters. Male: A3 length, wing length, genital pump; female: body length, labrum length, palp 2 and 3 length, total palp length, wing length, wing breadth, alpha, beta and gamma length. These results, recorded between two sympatric populations, are consistent with the hypothesis of speciation that was previously inferred on the basis of an isozymic study (Le Pont et al., 1985).

*P. yucumensis* was first caught on human bait in a primary forest area laying at the foot (elevation 250m) of the last subandean cordillera close to the village of Yucumo (annual precipitations = 1750mm) and appears to be the second most abundant anthropophilic species with *P. llanosmartinsi* behind *P. c. carrerai*; *P. yucumensis* is used to bite at ground level as do most of the *Psychodopygus* species. It was also caught very often in various stations of the rivers Quiquibey, Tuichi and Hondo, which are tributaries of the river Beni flowing in the broad valley between the two last cordilleras of the andean foothills. *P. yucumensis* seems to be linked to the lowland subandean region (elevation 200-400m), unlike *P. c. carrerai*, which seems to be able to adapt to slightly higher altitudes (200-1000m).

We have recently isolated from a *P. yucumensis* specimen caught on human bait in this area a *Leishmania* stock which was referred to *Leishmania braziliensis braziliensis* by isozyme analysis (Le Pont & Desjeux, unpublished data). It seems therefore worth continuing the ecological study of *P. yucumensis* and particularly its trophic preferences, which might clarify the "unsolved problem" (Lainson, 1983) of the *L. b. braziliensis* reservoirs.

TABLE III

Mean values of some measurements for *P. c. carrerai* (= MA) and *P. yucumensis* (= MB), and results of comparison by means of Student's t test

	MA	MB	df	t	p
<i>Male characters:</i>					
Genital filaments	0.590 (0.008)	0.586 (0.004)	29	0.48	NS
Labrum length	0.168 (0.002)	0.170 (0.002)	29	0.71	NS
A 3 length	0.227 (0.003)	0.218 (0.003)	29	2.39	0.05
Wing length	1.689 (0.024)	1.768 (0.013)	26	3.15	0.01
Wing breadth	0.501 (0.005)	0.512 (0.004)	26	1.62	NS
Genital pump	0.124 (0.002)	0.119 (0.002)	29	2.09	0.05
<i>Female characters:</i>					
Body length	2.127 (0.043)	2.241 (0.022)	18	2.39	0.05
Head length	0.412 (0.005)	0.411 (0.004)	18	0.08	NS
Head width	0.413 (0.006)	0.416 (0.010)	17	0.18	NS
Labrum length	0.257 (0.003)	0.272 (0.003)	38	4.11	0.001
A 3 length	0.227 (0.003)	0.232 (0.003)	38	1.25	NS
A 4 length	0.107 (0.002)	0.103 (0.001)	18	1.47	NS
A 5 length	0.105 (0.002)	0.102 (0.002)	18	1.41	NS
Palp I	0.036 (0.002)	0.035 (0.001)	18	0.42	NS
Palp 2	0.110 (0.003)	0.120 (0.002)	18	2.66	0.02
Palp 3	0.145 (0.003)	0.153 (0.002)	18	2.14	0.05
Palp 4	0.049 (0.002)	0.051 (0.001)	18	1.05	NS
Palp 5	0.068 (0.002)	0.070 (0.002)	17	0.76	NS
Total palp	0.407 (0.008)	0.428 (0.005)	17	2.34	0.05
Upper setae	12.333 (1.701)	15.506 (0.835)	13	1.59	NS
Lower setae	10.100 (0.609)	8.950 (0.418)	18	1.56	NS
Wing length	2.070 (0.026)	2.204 (0.019)	37	4.08	0.001
Wing breadth	0.620 (0.013)	0.656 (0.008)	17	2.22	0.05
Alpha	0.563 (0.017)	0.610 (0.012)	17	2.19	0.05
Beta	0.234 (0.011)	0.262 (0.007)	17	2.14	0.05
Gamma	0.181 (0.007)	0.147 (0.009)	17	2.95	0.01
Delta	0.171 (0.012)	0.166 (0.009)	17	0.34	NS

df = degree of freedom; t = value of t coefficient; P = level of significance (NS = non significant; the level of significance used is 0.05). In brackets: standard error.

## RESUMO

*Psychodopygus yucumensis* n.sp., uma nova espécie de flebotomíneo que pertence ao gênero *Psychodopygus* Mang., é descrita das espécies coletadas sobre o homem, no departamento de Beni, na Bolívia. Os indivíduos do sexo masculino são característicos das séries *panamensis*, mas as fêmeas, muito próximas de *P.c. carrerai*, podem ser confundidas com esta espécie ("cryptic species"). A caracterização isoenzimática pode determinar cada indivíduo das duas espécies, enquanto que a análise morfométrica demonstra diferenças estatísticas entre as duas espécies.

*P. yucumensis* é fortemente antropofílica. Uma cepa de *Leishmania braziliensis braziliensis* foi isolada desta nova espécie, indicando que ela é um dos vetores de leishmaniose mucocutânea na região subandina baixa.

## ACKNOWLEDGEMENTS

We are indebted to Professor F.J. Ayala (University of California, Genetics) who revised kindly the present manuscript.

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